Title: Let the Games Begin!

Brief Overview:

This unit involves the students in a variety of statistical tasks. The students will collect, organize, interpret, and display data. The students also will create and evaluate games using the principles of probability. The final assessment of this learning unit includes a writing prompt.

Links to Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate their ability to solve problems in mathematics including problems with open-ended answers, problems which are solved in a cooperative atmosphere, and problems which are solved with the use of technology.

- **Mathematics as Communication**
  Students will demonstrate their ability to communicate mathematically. They will read, write, and discuss mathematics with language and the signs, symbols, and terms of the discipline.

- **Mathematics as Reasoning**
  Students will demonstrate their ability to reason mathematically. They will make conjectures, gather evidence, and build arguments.

- **Mathematical Connections**
  Students will demonstrate their ability to connect mathematics topics within the discipline and with other disciplines.

- **Estimation & Computation**
  Students will demonstrate their ability to apply estimation strategies in computation, with the use of technology, in measurement, and in problem solving. They will determine reasonableness of solutions.

- **Number Sense & Operations**
  Students will demonstrate their ability to describe and apply number relationships using concrete and abstract materials. They will choose appropriate operations and describe effects of operations on numbers.

- **Statistics**
  Students will demonstrate their ability to collect, organize, and display data and will interpret information obtained from displays. They will write reports based on statistical information.

- **Probability**
  Students will demonstrate the basic concepts of probability such as predicting and finding probabilities.

- **Patterns & Relationships**
  Students will demonstrate their ability to recognize numeric and geometric relationships and will generalize a relationship from data.

- **Fractions & Decimals**
  Students will demonstrate and apply concepts of fractions, mixed numbers, and decimals; use models to relate fractions to decimals and to find equivalent fractions; compute with whole numbers, fractions, and decimals; and apply fractions and decimals to problem situations.

Grade/Level:

Grades 3-5

Duration/Length:

This learning unit takes approximately 5 days to complete. Each day's lesson should take 45 to 60 minutes depending on the grade level and ability of your students.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- reading, writing, and constructing fractions
- constructing a bar graph
- probability
- cooperative learning

Objectives:

Students will:

- collect, tally, and display data.
- interpret and write about information obtained from a bar graph.
- observe patterns and make predictions.
- work cooperatively.
- master the use of probability vocabulary.
- write to express probability.
- use and create a spinner.
- express mathematical concepts in written form.

Materials/Resources/Printed Materials:

- One commercial spinner per pair of students (divided into fourths)
- One commercial spinner per pair of students (divided into half)
- Plenty of graph paper
- One cardboard square per pair of students
- One paper clip per pair of students
- One black marker per pair of students
- One copy of each student resource page per student
- One copy of the rubric for the writing prompt

Development/Procedures:

Day 1:

1. The teacher will prepare the spinners before class. The spinners should be divided into four equal parts. The #1 should be written in 3 of the 4 parts. The #2 should be written in 1 of the 4 parts.

2. The teacher will distribute student resource page 1. The teacher will give a real-life application for each situation.

3. The teacher will divide students into groups of two. The pairs will remain the same all week.

4. The teacher will distribute student resource pages 2&3.

5. The students will make predictions about the outcome of the game.

6. The students will organize data and create a bar graph to display the entire class' data.

7. The students will express probability in fractions.

8. The students will explain whether or not the game is fair.

Day 2:

1. The teacher will prepare spinners before class. The spinners should be divided into 2 equal parts. The #1 should be written in 1 of the 2 halves. The number 2 should be written in the other half.

2. The teacher will distribute student resource pages 4 &5.

3. The students will make predictions about the outcome of the game.

4. The students will organize data and create a bar graph to display the entire class' data.

5. The students will express probability in fractions.

6. The students will compare and write about the graphs from days 1 and 2.

Day 3:

1. The teacher will distribute student resource page 6.

2. Each pair will construct their own spinner.

3. Each pair will create their own game.

4. Each pair will write the directions for their game.

Day 4:

1. The teacher will distribute student resource pages 7 &8.

2. Each pair will evaluate another pairs game.

3. The student will write a summary of the directions.

4. The students will test the game several times.

5. The students will collect data and draw conclusions about the game.

6. The students will express the conclusion in mathematical language.

Day 5:

1. The teacher will distribute student resource page 9.

2. The prompt should be scored using the rubric, teacher resource #1.

3. The students will work on the prompt for the remainder of the class period.

Performance Assessment:

The writing prompt on day 5 should be used as a final assessment of the students' knowledge of probability. The scoring rubric is found on Teacher Resource #1.

Extension/Follow Up:

1. Invite other classes to play the games.

2. Read Jumanji by Chris Van Alsburg

3. Evaluate commercial board games for fairness.

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NOTE: Student Resource Activities and Scoring Rubric are included!

Name_____

Vocabulary Word List

1. **Likely-** There is a good/high chance of the outcome happening.

2. **Certain-** There is a 100% chance of the outcome happening.

3. **Equally Likely-** There is an equal chance of an outcome happening or not happening. (50/50 chance).

4. **Less Likely-** There is a poor/low chance of the outcome happening.

5. **Outcome-** All the possible events that can occur.

Name_____

Extra Recess Game

Today you are going to play a game. Each pair of students have a spinner that is divided into four equal parts. Each part is labeled with a 1 or 2. If the class spins more ones, your teacher will give you extra homework. If the class spins more twos, your teacher will give you extra recess.

Partner's Name_____

1. Look at your spinner. You will spin it 20 times. Predict below how many of each number you expect to get.

   # of ones_____ # of twos_____

2. Explain your prediction. (Use words from the vocabulary word list.)

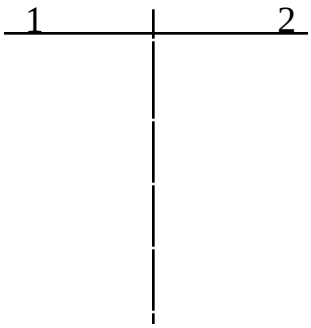
_____

_____

_____

_____

3. Now spin the spinner 20 times and tally your results.



4. Put your results on the chalkboard.

5. Now using your graph paper create a bar graph showing the entire class' results. (Be sure to label all parts!)

6. Write the fraction showing the relative frequency of spinning a 1.

7. Write the fraction showing the relative frequency of spinning a 2.

8. If you were to spin one more time, on which number is the spinner likely to land? _____

EXPLAIN YOUR CHOICE _____
_____
_____
_____

9. In your journal, write a letter to your teacher explaining whether you feel this game is fair or unfair. Be sure to include facts from your data to **support** your opinion.

Extra Recess Game Part Two

Yesterday you played a game. Today you will play the game again using a different spinner. The spinner is divided into two equal parts. Each part is labeled with a 1 or 2. If the class spins more ones, your teacher will give you extra homework. If the class spins more twos, your teacher will give you extra recess.

Partner's Name_____

1. Look at your spinner. You will spin it 20 times. Predict below how many of each number you expect to get.

   # of ones_____ # of twos_____

2. Explain your prediction. (Be sure to include some of the probability vocabulary from your word list.)

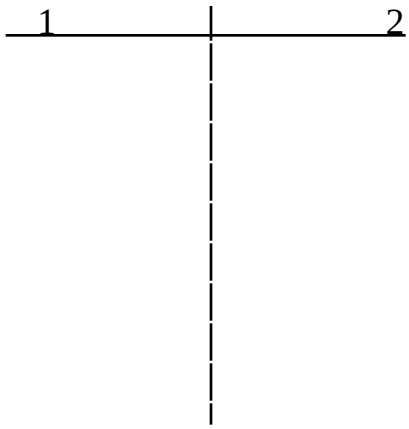
_____

_____

_____

_____

3. Now spin the spinner 20 times and tally your results.



4. Put your results on the chalkboard.

5. Now using your graph paper create a bar graph showing the entire class' results. (Be sure to label all parts.)

6. Write the fraction showing the relative frequency of spinning a 1.

7. Write the fraction showing the relative frequency of spinning a 2.

8. **Compare** your graph from yesterday to the graph you just completed. In your journal tell how and why the two graphs are different.

Name_____

Design A Game

You have been studying probability. Today you and your partner will design your own game using a spinner. Your game should be for two players.

Partner's Name_____

How To Make A Spinner:

1. Trace a circle onto the cardboard square.
2. Cut out the circle.
3. Decide how you will divide your spinner.
4. Use a black marker and ruler to divide your spinner.
5. Lay a paper clip on the center of the spinner.
6. Place the point of your pencil in the middle of the spinner.
7. Spin the paper clip.

Use the space below to write the directions for your game. Use the back if necessary. It is important to be clear so that other students will understand how to play your game.

Name of Game:_____
Number of Players: 2

Directions:

Name_____

Quality Control Report

The Furlow Toy Company is looking for new games for their company to sell. They need your help. You need to test each of the games created yesterday. The Furlow Toy Company only wants games where each player has an equal chance of winning.

Partner's Name_____

1. The Company does not want you to test your own game. **Explain** why?

_____

_____

_____

2. It is now time to exchange your game with the pair sitting closest to you.

   Name of Game _____

   Designed By _____

   &

   _____

3. Read the directions for playing the game and write a brief **summary** telling how to play. _____

_____

_____

Now you will test the game following the creators' directions carefully. Keep in mind that you are trying to discover whether or not each player has an equal chance of winning the game. You should repeat the game until you have collected enough data to draw a **conclusion**.

4. Using graph paper, **create** a graph showing the results of your test.

5. **Express** your results in mathematical language. Refer to your vocabulary list.

_____

_____

_____

_____

_____

Name _____

Writing Prompt

Yesterday you and your partner tested a game created by two of your classmates. The Furlow Toy Company is very interested in your findings. Remember they only want games that are fair. Write a report to Mrs. Furlow, chairperson of the new toy committee, telling her about the game you tested. Using your knowledge of probability, decide whether or not she should accept the game. Support your decision with evidence from your tests and be able to justify your opinion.

Rubric For Writing Prompt

0 Points

*No response given.
*The writing is unreadable.

1 Point

*The writing is off the topic.
*The student made an attempt, however, the information is incorrect.

2 Points

*The writing shows some organization.
*The writing is on the correct topic.
*The writer made a decision.
*The writer did not support their decision.
*The language usage is below 80% accuracy.

3 Points

* The writing has good organization.
* The writer supports his decision with two pieces of data.
* The writer uses some probability language.
* The language usage is at least 80% accurate.

4 Points

* The writer supports his decision with three or more pieces of data.
* The language usage is at least 81% accurate.
* The writer uses the probability vocabulary with proficiency.
* The writer accesses his prior knowledge in his writing.